Electronic Systems Center Acquisition Development Office

Spiral Development Workshop

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27 January 1999

Outline

- Purpose
- Background
- Problem Statement
- Traditional Development Process
- Grand Design Strategy
- Evolutionary Acquisition Strategy
- Spiral Development Process
- Summary
- Conclusion

Purpose

- Explain Why We Need to Change
- Explain How Evolutionary Acquisition Using Spiral Development Helps Meet ESC Objectives
- Obtain Feedback

Background

- Threat
- Resources
- Acquisition Reform
- DoD R&D Small Relative to Commercial
- Force Structure
- Accelerating Change

Air Force Command & Control Summit
(11 April 1997)

- C2 Needs to Change
- Directed
  - … Manage C2 as a Weapons System
  - … Created The Air & Space Command and Control Agency (ASC2A)
  - … Implement Evolutionary Acquisition & Spiral Development
  - … Expeditionary Force Experiment (EFX)

ESC's #1 Leadership Priority

Achieving an Acquisition Cycle Time of 18 Months or Less

Enabler → Commercial Technology & Practice

T_0 = $ In Hand

T_{18} = Supportable Capability In User's Hand

T_0 = $ In Hand

- Motivates Behavior Change - Better Planning
- More Timely Obligation/Expenditures
- Credibility That We Can Execute In Less Than Budget Lead Time

Problem Statement

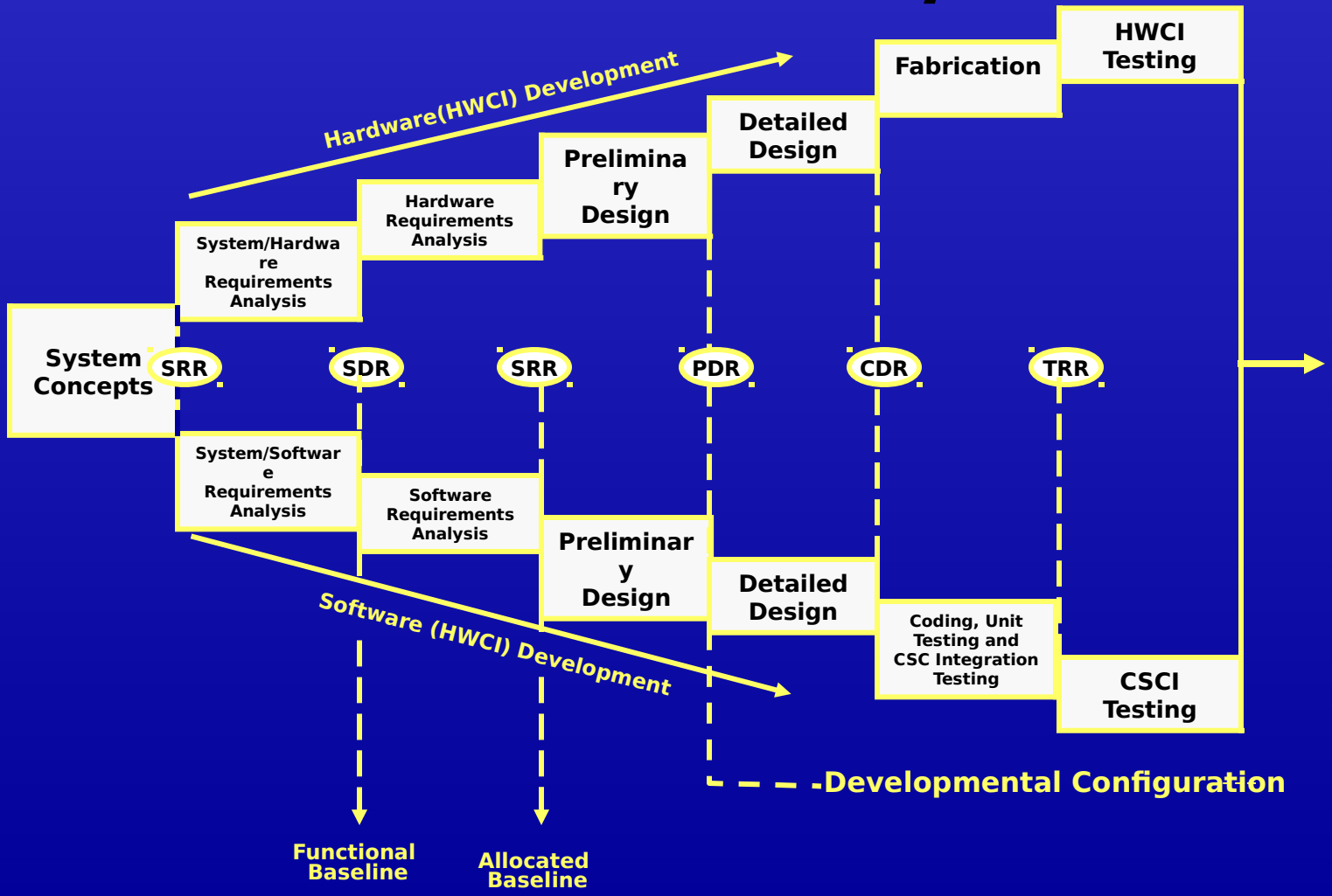
The Traditional Development Process Does Not Allow for Predictable Schedule or Customer/User Continuous Involvement

Traditional Development Process

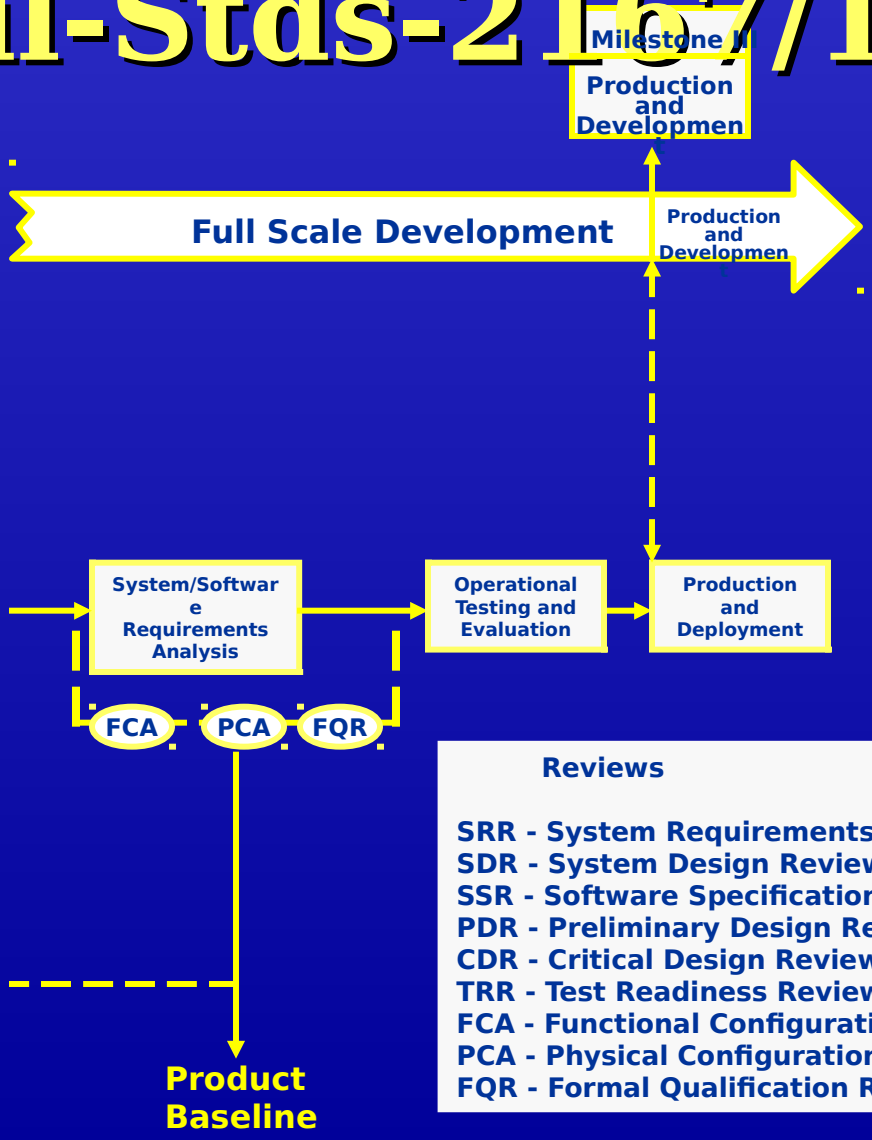
A Development Process that Consists of a Once Through, Do-Each-Step-Once. Determine User Needs, Define Requirements, Design, Implement, Test, Fix and Deliver, With Emphasis on

Performance = Independent Variable

Traditional Development Process Mil-Stds-2167/1521



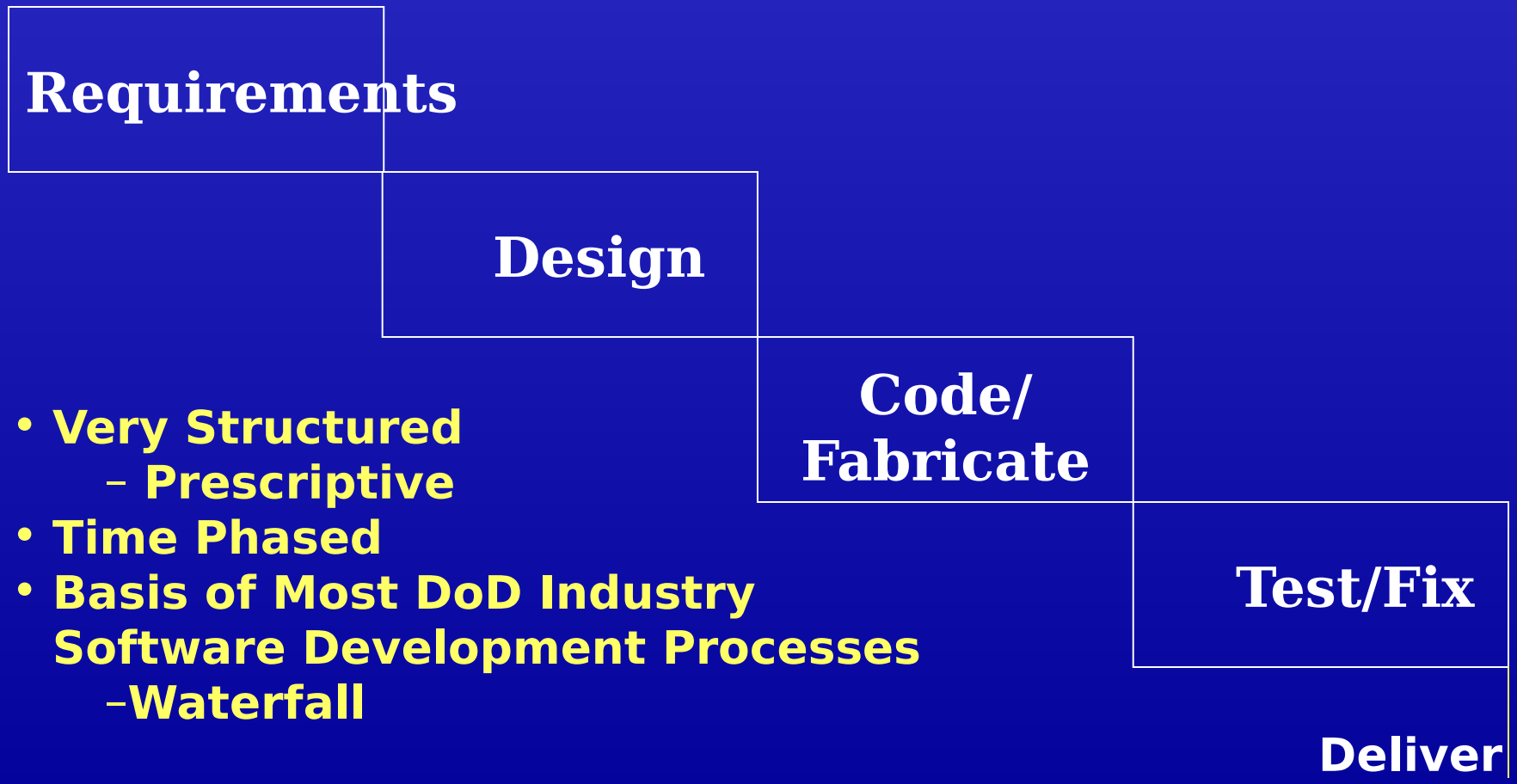
Traditional Development Process Mil-Stds-2167/1521



Reviews

SRR - System Requirements Review
SDR - System Design Review
SSR - Software Specification Review
PDR - Preliminary Design Review
CDR - Critical Design Review
TRR - Test Readiness Review
FCA - Functional Configuration Audit
PCA - Physical Configuration Audit
FQR - Formal Qualification Review

The Traditional Development Process



- Very Structured
  - Prescriptive
- Time Phased
- Basis of Most DoD Industry Software Development Processes
  - Waterfall

Problems with Traditional Development Process

- Requires Firm and Complete Requirements
- Limited Tradeoff Opportunities
  - Extend Program Cost and Schedule
  - May Result in System Deficiency
- Difficult to Maintain Schedule

Traditional Development Process (cont'd)

- Limited User Participation or Feedback
  - Limited User Dialogue During Design/Development
  - Little or No Hands On Until IOT+E
- Lengthy Cycle Time Results in Loss of Continuity (User/Tester/SPO Turnover)
  - Creates Program Instability

Traditional Development Process (cont'd)

- Test (Pass/Fail)/Quantitative
  - Full Requirement
- Support & Training Done Organically in Many/ Most Cases
- Sustainment of the System Limits Improvement
- Environmental Changes
  - Threat
  - Technology
  - Force Structure

Traditional Development Process (cont'd)

- System Deliverables Not Meeting User Expectations
  - Lack of User Involvement Throughout Acquisition Process
  - User Lack of Understanding of Acquisition Process
  - External Input
    - Contractor Marketing and Other Influences

Application of Traditional Development Process

Now We Will Overlay the Traditional Development Process on Two Different Acquisition Strategies.

- **Grand Design**
- **Evolutionary Acquisition**

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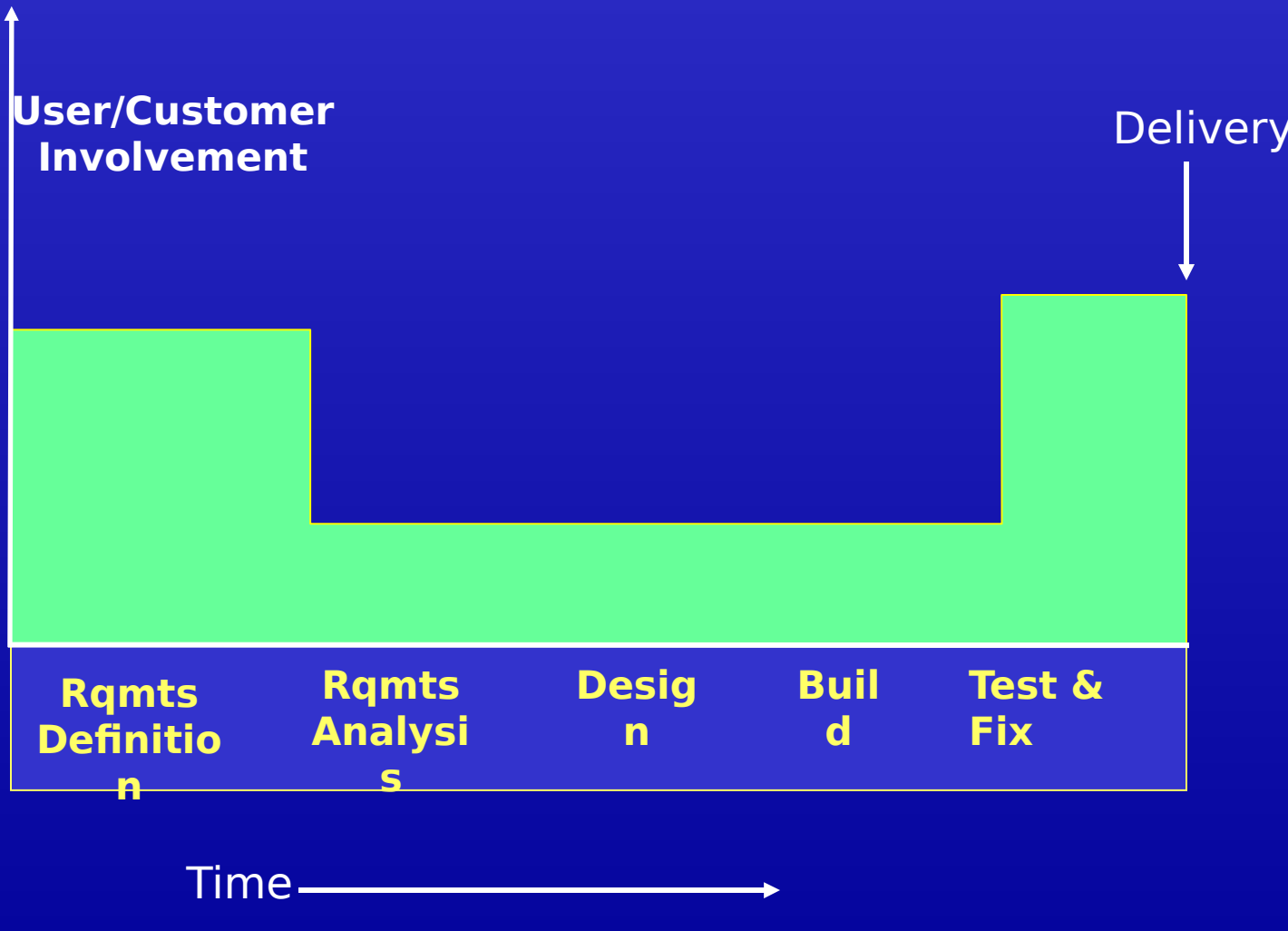
Grand Design

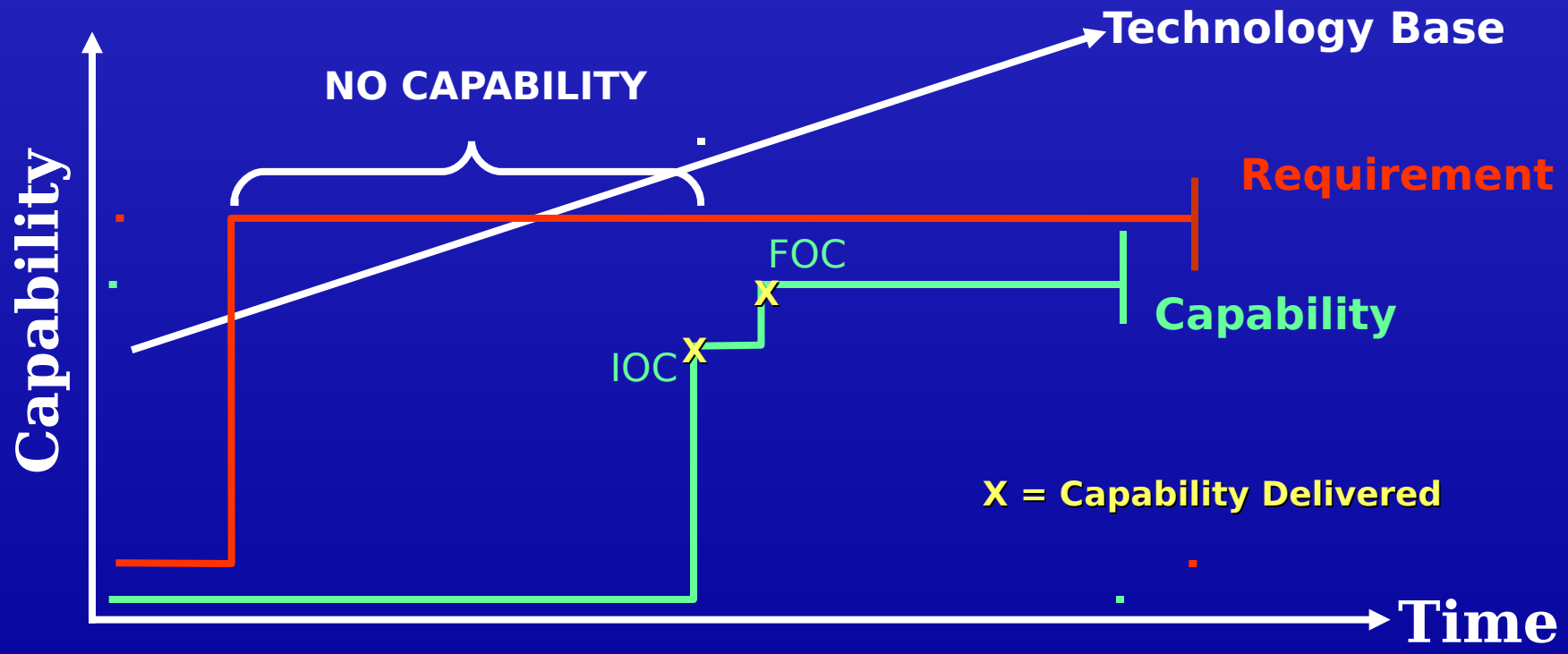
An Acquisition Strategy That Delivers a System to the User Based Upon Requirements Agreed to at the Start of Development. There Are No Incremental Deliveries.

Grand Design Strategy

Traditional Development Approach



Grand Design/Traditional Development



Evolutionary Acquisition

An Acquisition Strategy That Results in the Early Fielding of an Initial System With Limited Capability, That Allows for Follow-on Enhancements That Incorporate Planned Additional Capability and Improvements Based Upon Feedback From Users. This Strategy Can Continue With No End State.

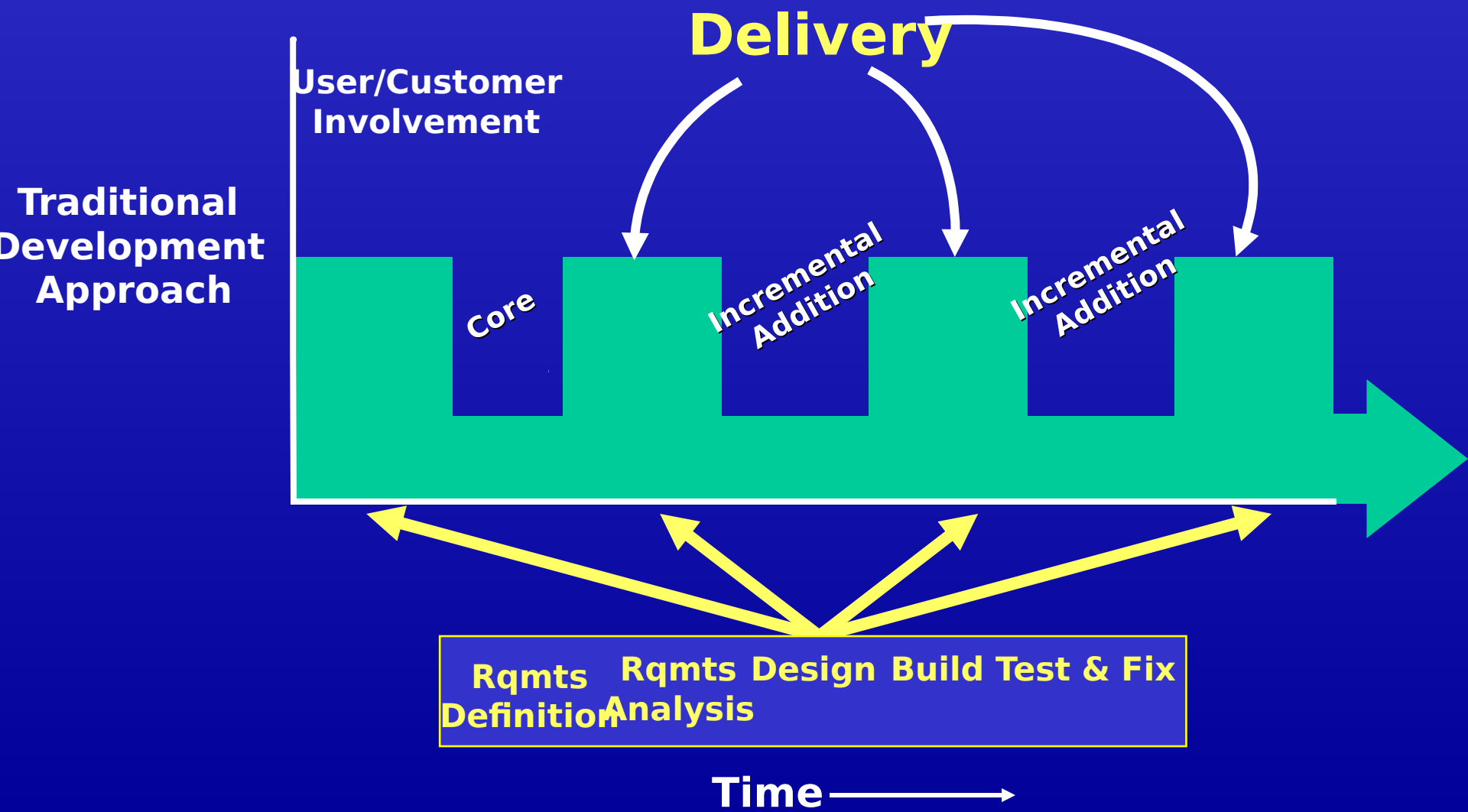
Evolutionary Acquisition Criteria for Use

- Software Intensive Systems
- Systems Using Rapidly Changing Technology
- Humans Are an Integral Part of the System
- Large Number of Diverse Users
- The System Is Unprecedented
- A Limited Capability Is Needed Quickly

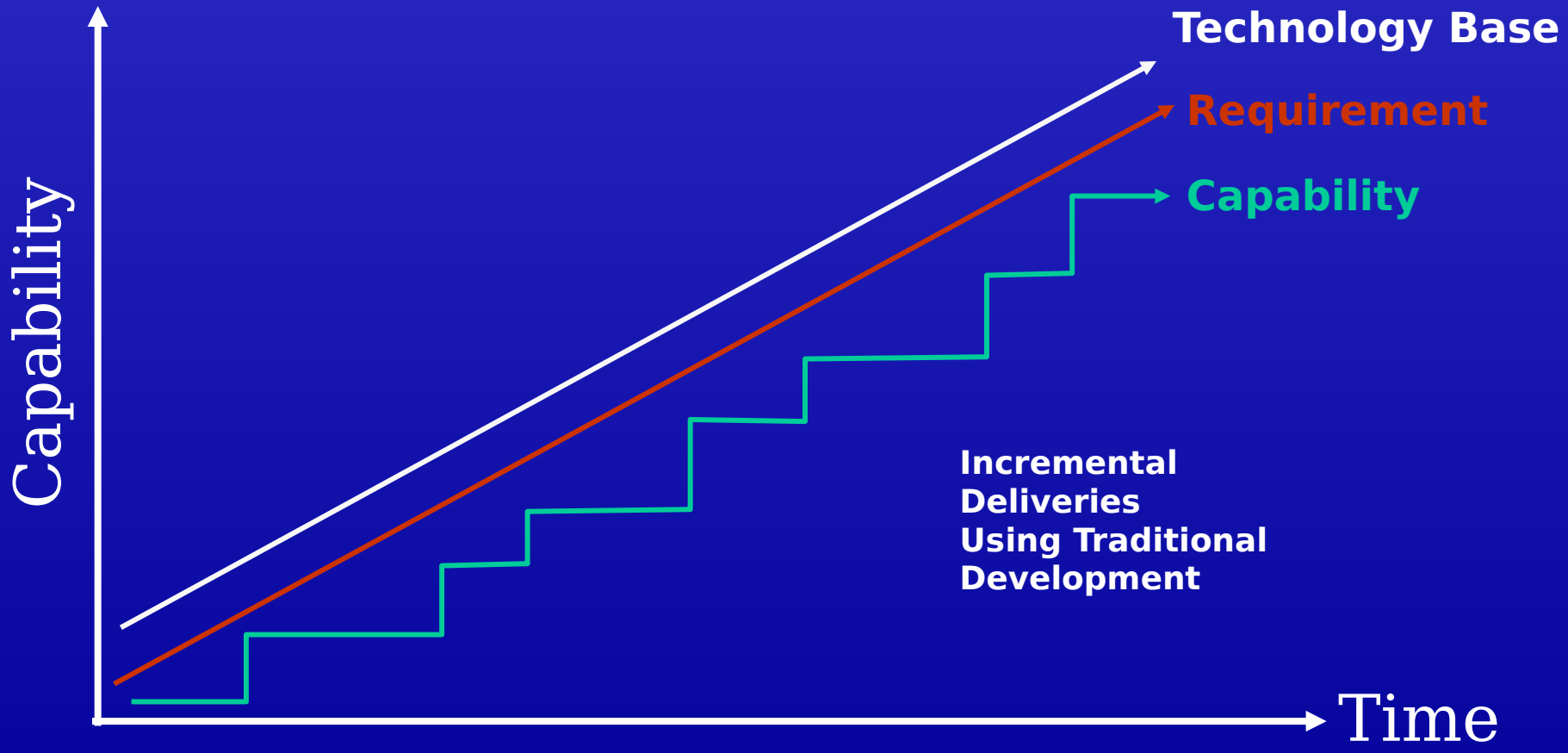
Evolutionary Acquisition Benefits

- Better Defined Requirements Earlier in the Acquisition Process
- Fielding an Early Operational Capability
- Systems More Closely Meeting User Needs
- Ability to Incorporate New Technology
- More Control and Visibility of Program Progress
- Continuous Improvement Over the Life of the System

Evolutionary Acquisition



Evolutionary Acquisition/ Traditional Development



Evolutionary Acquisition Conclusion

Evolutionary Acquisition Benefits Are Diluted Through Application of the Traditional Development Process. Need a New Development Process to Realize Full Benefits of Evolutionary Acquisition

New Development Process Requirements

- More User/Customer Involvement
  - Meet User Expectation
  - Mitigate Risk
- Maintainable Schedules
- Disciplined Approach

Schedule = Independent Variable

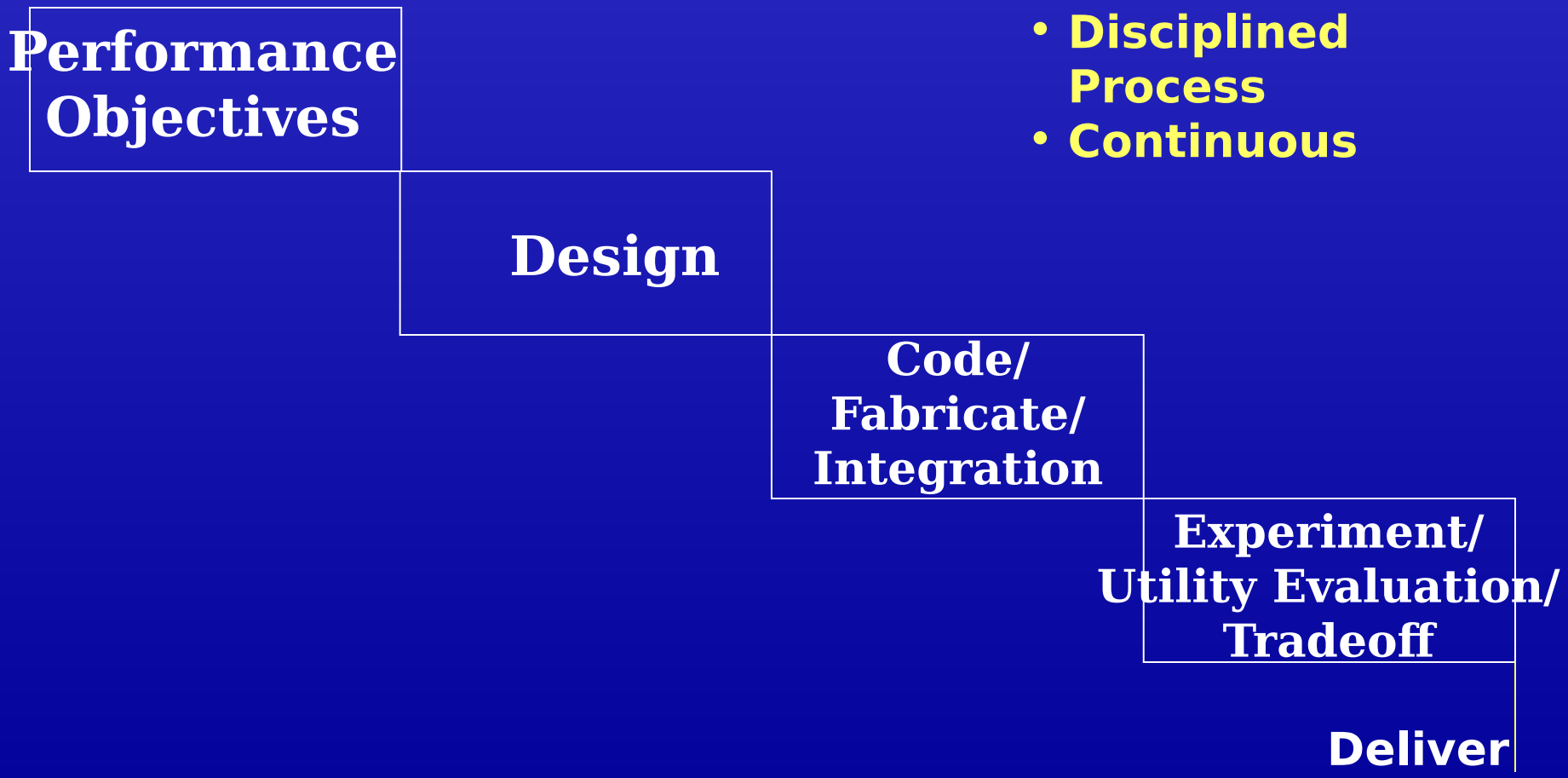
New Development Process Characteristics

- Team of Stakeholders Motivated to Collaborate
- A Development Plan and Decision Process
- Process Refines Capstone Requirements
- Establish Firm Schedule Per Increment
- Continually Negotiate Performance and Cost

New Development Process Characteristics (cont'd)

- Test/Experiment
  - Use Combined Test Force (CTF), CUBE and the C2TIC, Etc…
- Ends at a Predetermined Time With the Users Decision to Field, Continue Development or Both

Spiral Development



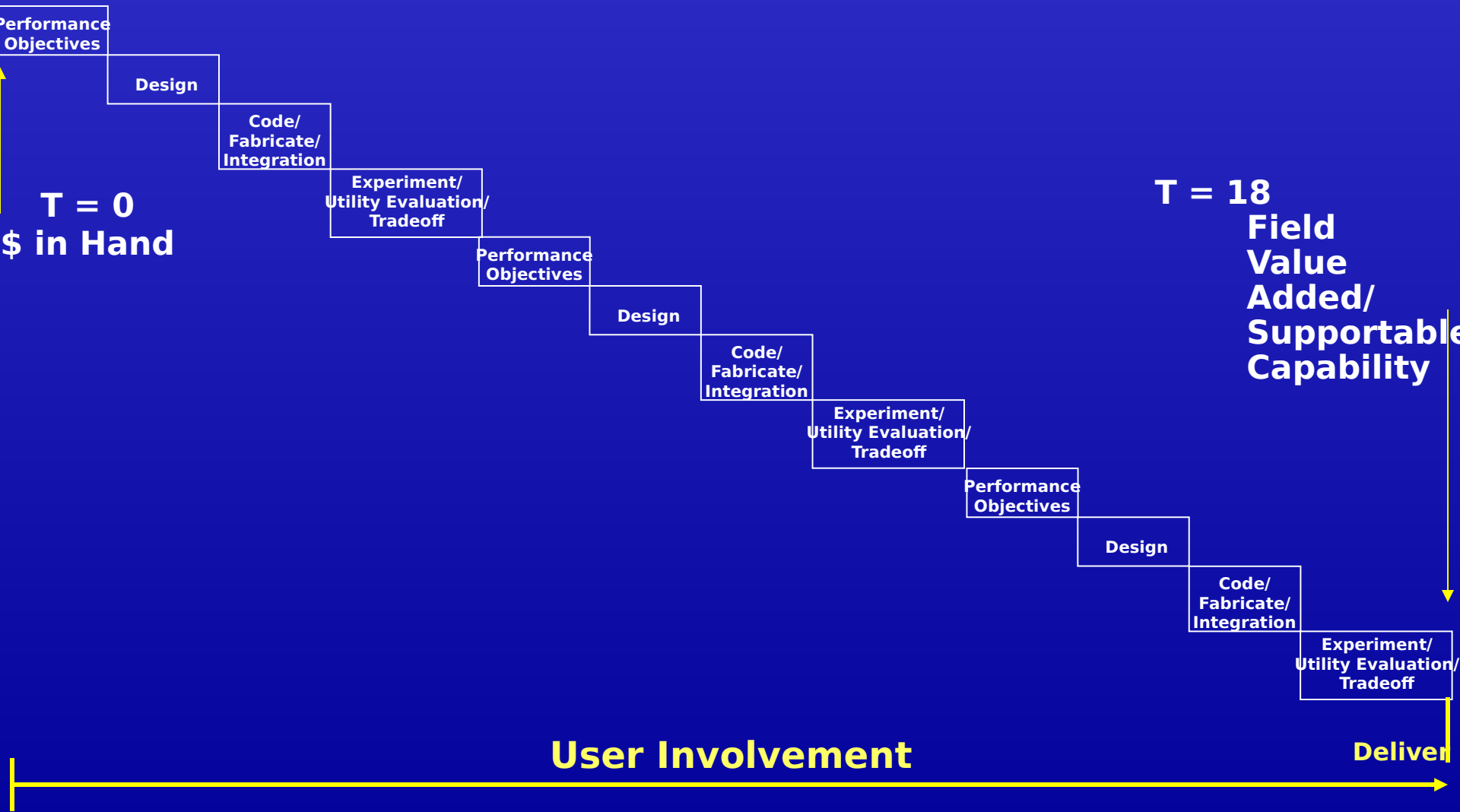
- Disciplined Process
- Continuous

Spiral Development Process

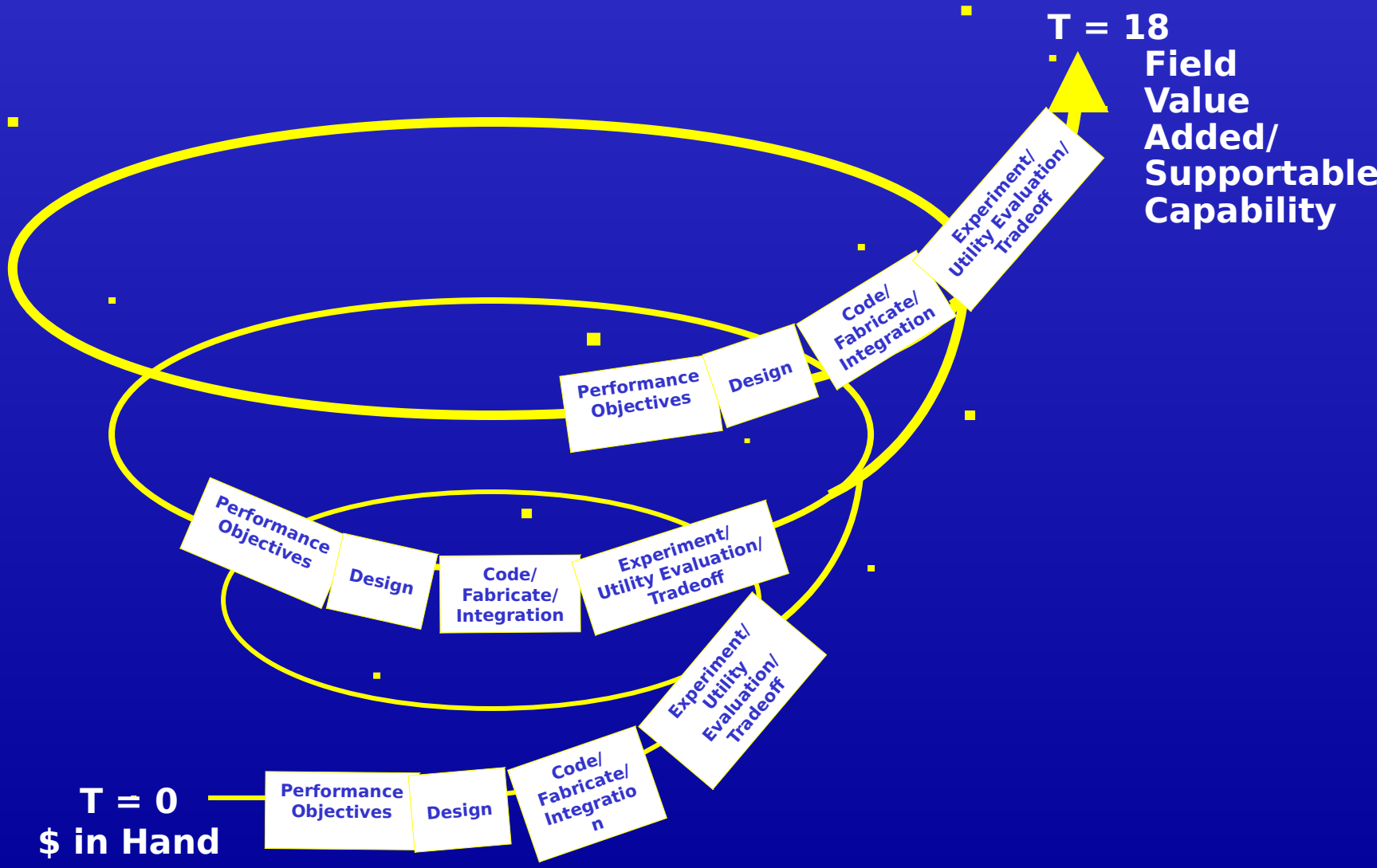
- A Development Process That Repeats Each Step Multiple Times. Steps Include: Establish Performance Objectives, Design, Code/Fabricate/Integrate, Experiment, Make Tradeoffs, Assess Operational Utility and Deliver. Emphasis Is on Schedule

Schedule = Independent Variable

Spiral Development Process



Spiral Development Overview



Team of Stakeholders

- Establish Empowered Integrated Product Team
  - Includes at a Minimum User/Customer, Tester and Acquirer
    - Others as Necessary e.g. Contractor, Platform Owner, Infrastructure Owner, Policy and Guidance, Science and Technology, Etc.
- Responsibilities
  - Establish Performance Objectives
  - Create Incremental Development Plan
  - Conduct Experimentation and Utility Assessments
  - Make Tradeoff Decisions

Discipline

- Single Acquisition Management Plan (SAMP)
  - Describes Overall Programs Objectives for the Program
  - Documents Decision Process
  - Identifies Membership of IPT and Documents the Process for Changing the IPT Membership
  - Documents the Overall Strategy for Achieving the Users Vision of Capability

Discipline (cont'd)

- Spiral Development Increment Plan (SDIP)
  - Establishes Increment Performance Objectives
  - Outlines the Plan to Achieve a Deliverable/ Supportable Capability to the User Within a **Fixed Schedule**.
  - Identifies Needed Resources

Discipline (cont'd)

- Spiral Development Decision Memorandum (SDDM)
  - Used to Document Tradeoff Decisions
  - Signed by Each Voting Member of IPT
  - Failure to Reach Consensus Must Be Reported to Milestone Decision Authority (MDA)
  - Acquisition Program Baseline Breaches Reported to MDA

Spiral Development Decision Process

SUB-PROCESSES

- Experiment / Test
- Risk Analysis
- System Engineering
- Cost/ Schedule Estimate

CUBE C2TIC

Day 0 Val Req $s	Utility, Evaluation & Tradeoffs	Utility, Evaluation & Tradeoffs	Utility, Evaluation & Tradeoffs	Utility, Evaluation & Tradeoffs	Final Utility, Evaluation & Tradeoffs	System Cert

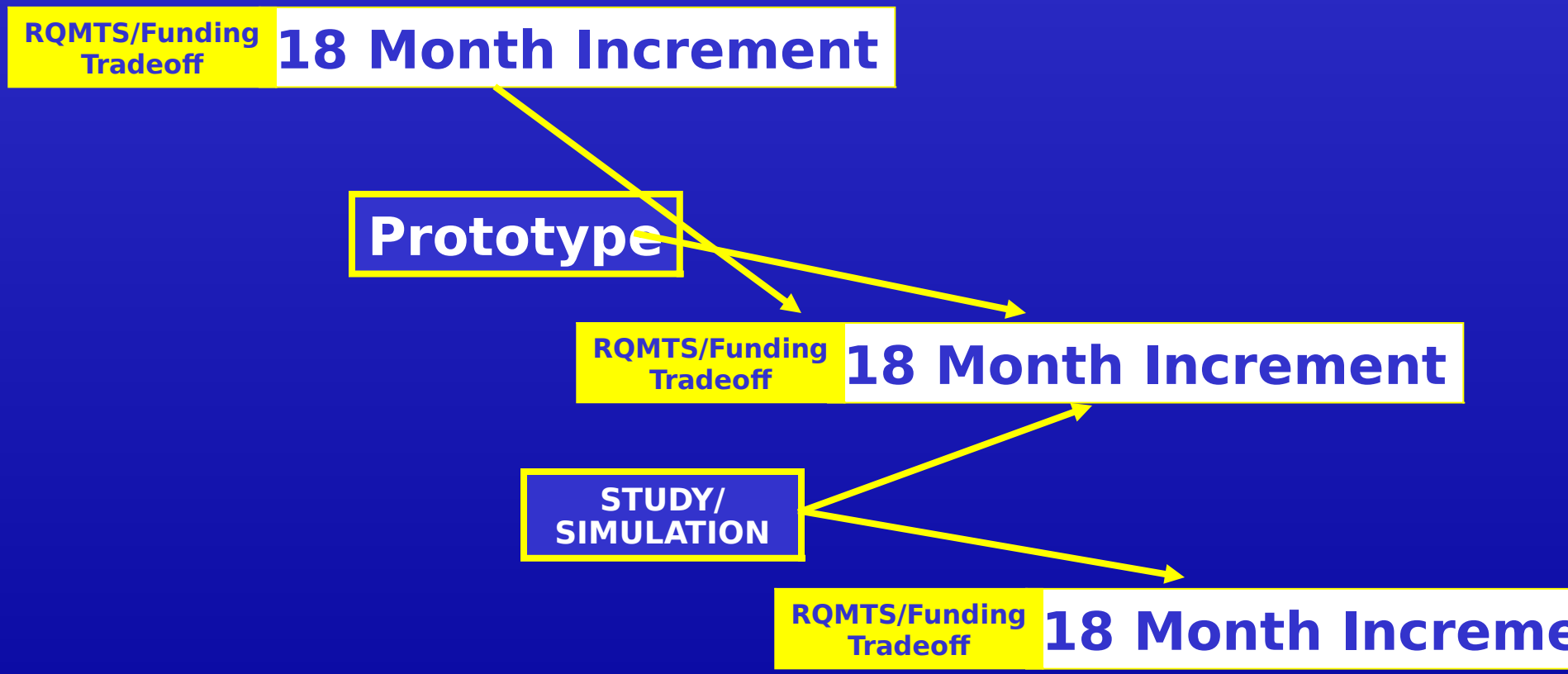
Del 18 Mos

IPT

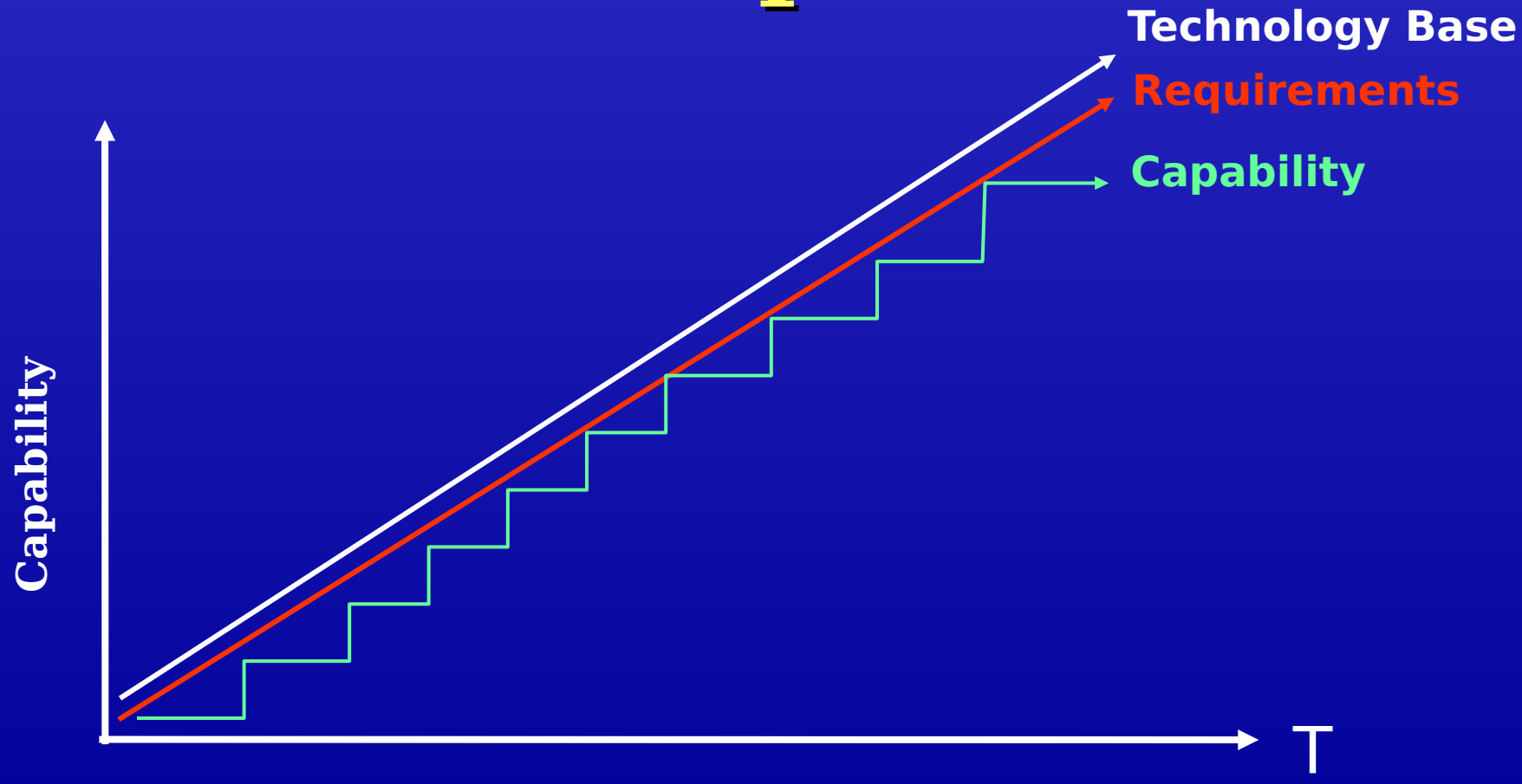
User
Developer
Tester
Others (as Needed)

TIME

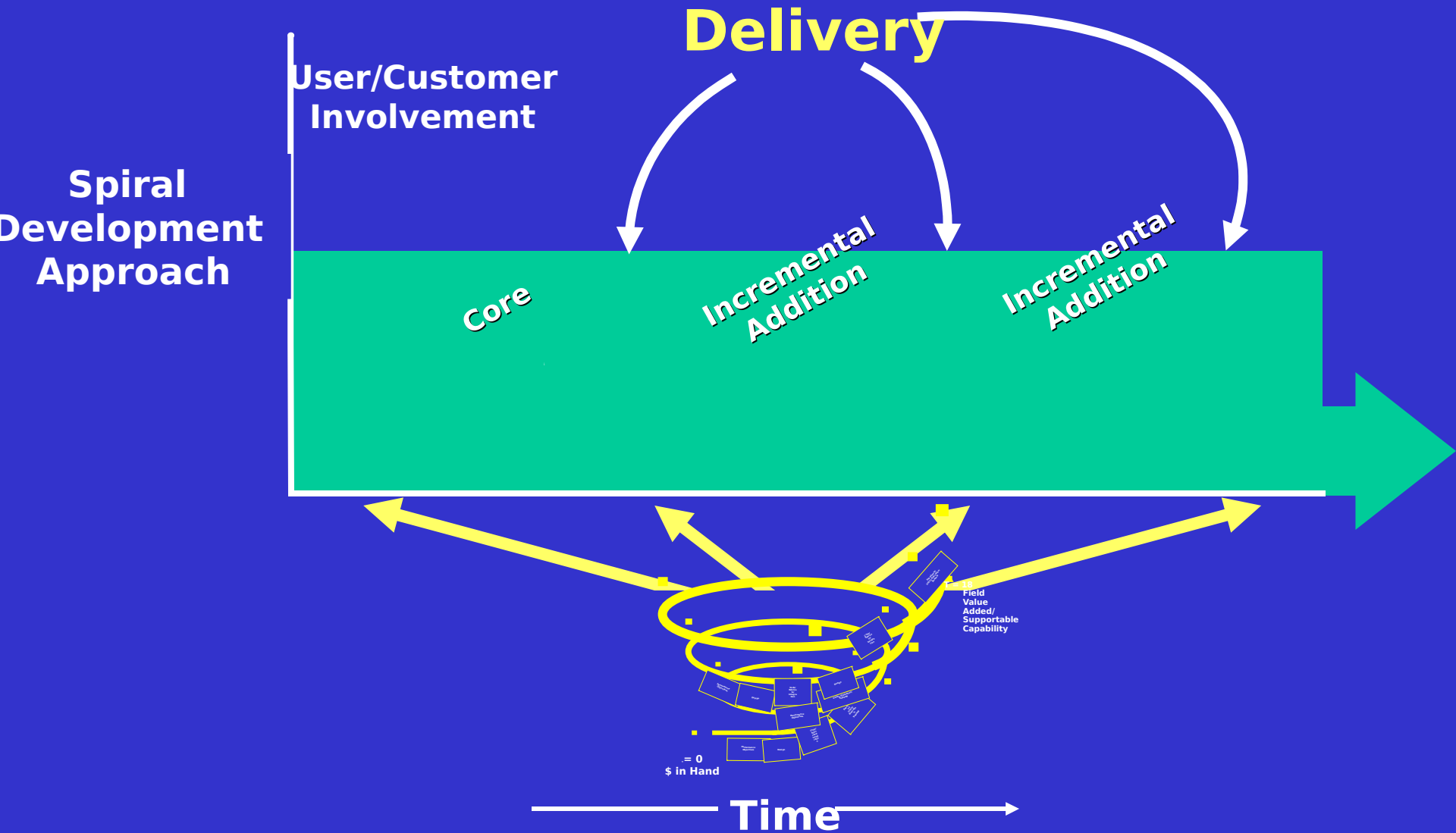
Evolutionary Acquisition Overview



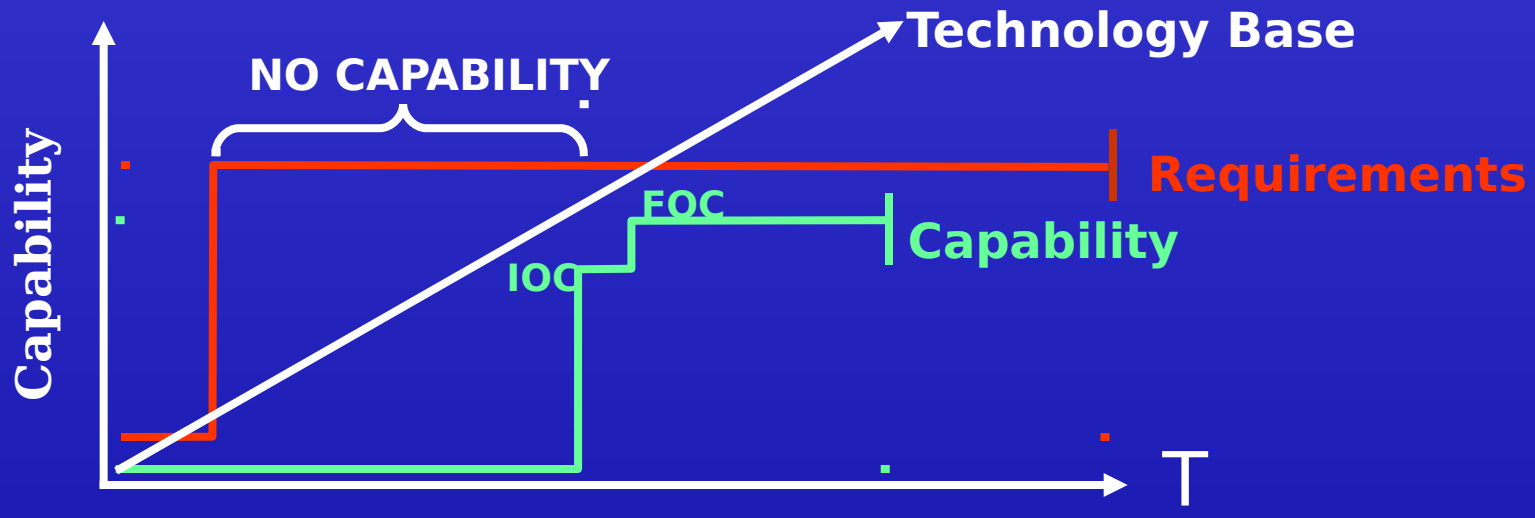
Acquisition Using Spiral Development Example



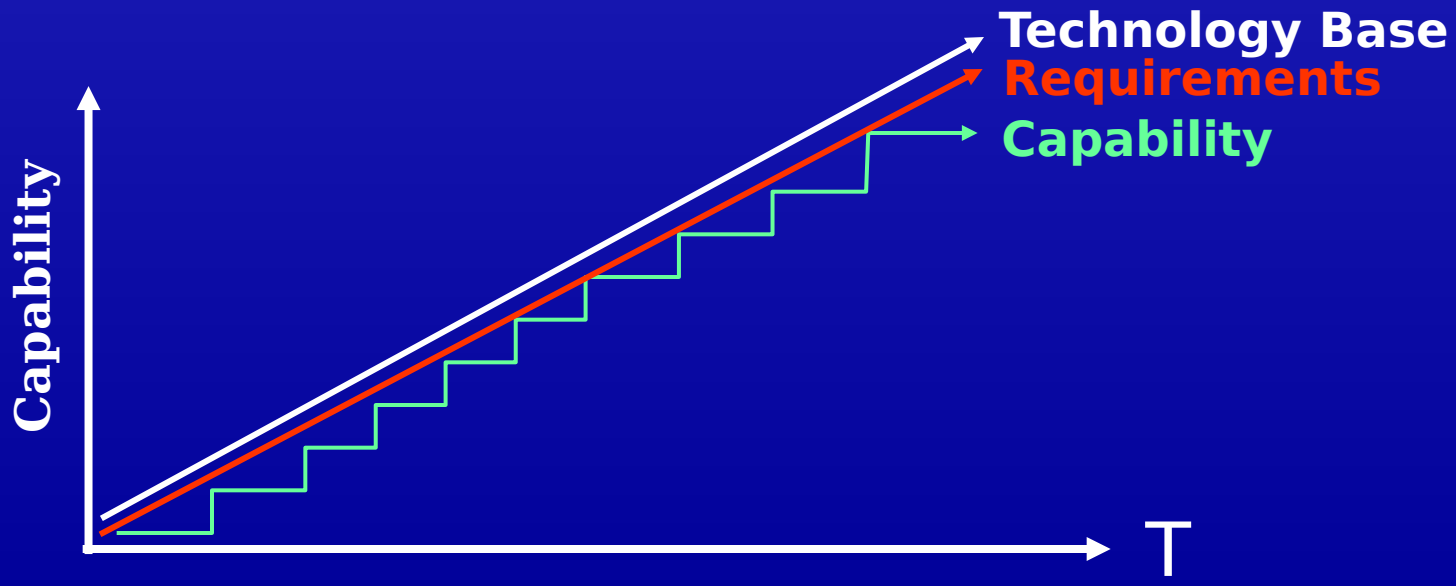
Evolutionary Acquisition



Grand Design/Traditional Development



Evolutionary Acquisition/Spiral/Development Incr. D



Conclusion

Evolutionary Acquisition Using a Spiral Development Process Meets ESC's #1 Leadership Priority of Reducing Cycle Time